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## BACTERIOLOGIC STUDIES OF THE UPPER RESPIRATORY PASSAGES

### IV. THE INCIDENCE OF PNEUMOCOCCI, HEMOLYTIC STREPTOCOCCI AND INFLUENZA BACILLI (PFEIFFER) IN THE NASOPHARYNX OF TONSILLECTOMIZED AND NONTONSILLECTOMIZED CHILDREN

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It was noted previously by Pilot and Davis<sup>1</sup> that the incidence of hemolytic streptococci was less in the oropharynx of tonsillectomized than in the nontonsillectomized, the organisms occurring in 15.8% in few numbers in the former group as compared with 58% in larger numbers in the latter group. Nichols and Bryan<sup>2</sup> reported the disappearance of these organisms from the throat in 27 of 31 patients 11 days after extirpation of diseased tonsils. Simmons and Taylor<sup>3</sup> noted the streptococci in fewer numbers in a somewhat larger percentage (23%) after tonsillectomy. Tongs<sup>4</sup> found these streptococci in 5% of tonsillectomized persons as compared with 60% of the cultures of the surface of the tonsils of the nontonsillectomized. Van Dyke<sup>5</sup> obtained positive cultures in 16.4% of tonsillectomized persons, mostly adults. In all of these investigations cultures were made of the pharynx or the region of the tonsils, and studied with special reference to the incidence and numbers of hemolytic streptococci. In all it is quite evident that tonsillectomy reduces considerably the frequency of *Streptococcus hemolyticus*. As no nasopharyngeal cultures were made, a study was undertaken of the flora of the nasopharynx with reference to the pneumococcus and the influenza bacillus, as well as the hemolytic streptococcus in children whose tonsils and adenoids had been removed, and a comparison made with a similar group in which tonsils and adenoids were present. The investigation was carried out from September to December, 1920.

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<sup>1</sup> J. Infect. Dis., 1919, 24, p. 386.

<sup>2</sup> Jour. Am. Med. Assn., 1918, 71, p. 1872.

<sup>3</sup> Ibid., 1919, 72 p. 1885.

<sup>4</sup> Ibid., 1919, 73, p. 1050.

<sup>5</sup> Ibid., 1920, 74, p. 448.

The children studied were normal girls and boys from 5 to 15 years of age of the Marks Nathan Orphan Home. In some the tonsils and adenoids had been removed from 2 months to 5 years previously. All the children had normal temperature and no subjective or objective evidences of acute inflammation of the throat or respiratory passages. The nasopharynx was swabbed with a curved wire swab which was spread on 10% human blood-agar and 5% heated blood-agar plates, and then placed in infusion broth and incubated for 24 hours. The infusion broth cultures were then inoculated into melted blood agar and poured plates made. The blood-agar plates were examined particularly for the pneumococcus, the heated blood-agar plates for the influenza bacillus and the poured plates for the hemolytic streptococcus (Table 1).

TABLE 1  
THE INCIDENCE OF PNEUMOCOCCI, HEMOLYTIC STREPTOCOCCI AND INFLUENZA BACILLI IN  
TONSILLECTOMIZED AND NONTONSILLECTOMIZED CHILDREN

Organisms	Number of Persons	Tonsillectomized Percentage Positive	Number of Persons	Nontonsillectomized Percentage Positive
Pneumococcus .....	49	32.5	68	32.3
Streptococcus hemolyticus .....	27	40.8	40	60
B. influenzae .....	29	26.5	35	37.1

*Pneumococcus*.—Small flat checkered colonies were isolated and inoculated into plain broth. They were then studied as to morphology, bile solubility, inulin fermentation and specific agglutination with types 1, 2 and 3 serums. In 49 children without tonsils and adenoids pneumococci were identified in 15 (32.5%). Ten of these strains were type 4, 2 type 3, 1 type 2a and 2 type 1. In one instance a green streptococcus insoluble in bile, but which fermented inulin, was found. In the 68 with tonsils and adenoids the pneumococcus occurred in 21 (32.3%), of which 20 were type 4 and one type 2a. In two instances a green streptococcus bile-insoluble but fermenting inulin was encountered. In 8 children whose throats revealed remnants of tonsils the pneumococcus was present in 3; two of the strains were of type 4, the other type 3. It was noted throughout that while the percentage of pneumococci did not differ in the 2 groups, the number of colonies of pneumococci when present was fewer in the cultures from the tonsillectomized than those from the nontonsillectomized.

*Streptococcus hemolyticus*.—Small gray colonies with zones of complete hemolysis from 1 to 4 mm. wide corresponding to the beta type of the streptococcus hemolyticus were isolated. These organisms fer-

mented lactose and salicin, but did not ferment inulin or mannite. They were pathogenic for rabbits, one blood-agar slant usually causing arthritis and often death in a young rabbit. They resembled in their properties the hemolytic streptococci of the crypts of the tonsils and adenoids. In 27 children whose tonsils and adenoids were absent the beta type of streptococcus was found in 11 (40.8%); the alpha type occurred in one instance. In 40 children with tonsils the beta type was present in 24 (60%) and in 2 the alpha was encountered. Of the 8 with remnants beta type was present in 3 and the alpha in 2. It is interesting to note that in the cases with tonsils the hemolytic streptococci were often present in moderate numbers only occasionally exceeding 10% of the total colonies on the plate. In the cultures from the children without tonsils the number of colonies was decidedly less, in none exceeding 10% of the total number and in 3 instances only a single colony was present.

*B. Influenzae*.—On the heated blood-agar plates typical gray, often flat, colonies were studied and subcultivated. The organisms were small gram-negative bacilli often pleomorphic, particularly on the subcultures. Transfers were made on infusion agar where no growth occurred when the organisms were true influenza bacilli. They were further subcultivated on unheated blood-agar slants and another organism (staphylococcus) streaked linearly on the same slant. The influenza colonies showed the property of symbiosis growing in larger size and numbers about the foreign organism. Of 29 persons whose tonsils were absent, 8 (26.5%) gave positive cultures for *B. influenzae*. Of 35 whose tonsils were present, 13 (37.1%) were positive. In the 8 with remnants, 4 gave positive results. Here also it is noteworthy that the number of colonies were more numerous in the cultures of the nontonsillectomized group.

#### SUMMARY

Pneumococci, hemolytic streptococci and *B. influenzae* were often found in the nasopharynx of normal children.

The incidence and numbers of hemolytic streptococci and influenza bacilli in the nasopharynx is decidedly less in the children whose adenoids and tonsils had been removed. In case of the pneumococcus the numbers are less in the same children than in those whose tonsils were present.

The removal of tonsils and adenoids reduces the number of certain bacteria in the oro-pharynx and naso-pharynx, but does not cause their disappearance.